

PHYS 1401 General Physics I
Homework #10

For the first three questions, express your final answer in the form of a *complete sentence*, with the correct units and number of significant figures. Do not just circle a number. Show all calculations, and draw diagrams where appropriate. The last six questions are found on the [Mastering Physics](#) site, and are worth a point each.

It would be a good idea to try the Tutorials before tackling the homework problems. If you complete the entire Tutorial for Homework #10, you will get 1 bonus point. If you complete any part of the Tutorial, you will get half a bonus point.

Do these problems on paper and turn them in

- (2 points) A toy gun has a barrel 7.25 cm long and a spring with a spring constant of 82.3 N/m. When ready to fire, the spring is compressed the length of the barrel, and when the 25.5 gram dart leaves the gun, the spring is at its natural length.
 - If the gun is fired perfectly horizontally, what is the speed of the dart as it leaves the gun?
 - If we fired the gun perfectly vertically, what additional type of energy would we have to worry about?
 - What would be the speed of the dart as it leaves the gun if it is fired vertically? A good diagram really helps here!
 - How high above the gun does the dart get if fired vertically?
- (1 point) Jane is swinging from a vine 39.4 meters long that would reach all the way to the ground if it were vertical. She begins in a tree with the vine making an angle of 27.5 degrees to the vertical.
 - How high off the ground is Jane when she begins?
 - What is her speed at the bottom of the swing?
 - Tarzan is waiting for Jane on the opposite side of the tree she is swinging from, on a tree branch 2.7 m above the ground. Calculate her speed in miles/hour when he reaches her, and decide if maybe he should get out of the way.
- (1 point) Bats “see” by hearing the echoes of the sounds they make. This helps them detect obstacles to fly around as well as find delicious insects to eat.
 - On a night when the temperature is 22 degrees Celsius, how fast do the bat’s sounds travel?

- b. The bat is 25 meters away from a wall. How long after it emits the sound does it take the bat to hear the echo caused by the wall?
- c. The bat can only “see” a bug if the length of the bug is more than the wavelength of the sounds it emits. Otherwise, the sound waves will not reflect off of it. Can the bat detect an insect 5.1 mm long, if it is emitting a sound of frequency 101,000 Hz?

These are the problems from the book that are online. The data are different, so you can work them out without numbers and then go online.

1. Chapter 7, problem 28, p. 216
2. Chapter 7, Problem 42, p. 217
3. Chapter 7, Problem 52, p. 218
4. Chapter 12, Problem 34, p. 394
5. Chapter 12, Problem 40, p. 394
6. Chapter 12, Problem 62, p. 395